Chapter 4

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Refuge trails in the Winter

Environmental Consequences

Introduction

This chapter describes the foreseeable environmental consequences of implementing the management strategies in alternatives in chapter 2: alternative A, "Current Management," which continues our current management unchanged and serves as the baseline for comparing alternative B, "Expand Biological Monitoring and Enhance Public Awareness and Education." When detailed information is available, we present scientific, analytical comparisons between the alternatives and their consequences, which we describe as "impacts" or "effects." In the absence of detailed information, we base those comparisons on our professional judgment and experience.

We focus on the impacts associated with the goals and significant issues in chapter 1, "Purpose and Need for Action," in discussing the direct, indirect, short-term, beneficial and adverse effects likely over the 15-year span of the plan. Beyond that 15-year planning horizon, our description of those effects is more speculative. This chapter also identifies any irreversible and irretrievable commitment of resources and the relationship between short-term uses of the environment and its long-term productivity. At the end of this chapter, table 4.2 presents a side-by-side comparison of the consequences of each alternative.

When we lack information to quantify those consequences, we use the qualitative terms "positive," negative," or "neutral." A positive impact enhances or benefits the resources under consideration, and helps accomplish refuge management goals and objectives over the short term (<15 years) or long term (>15 years). A negative impact implies an action that we predict would be detrimental to a resource over the short or long term, and possibly, adversely affect our ability to achieve refuge purposes, goals, or objectives. A neutral impact means either (a) no discernible effect either positive or negative, or (b) positive and negative effects would cancel each other out.

Our geographic context primarily focuses on refuge lands, waters, and the area nearby. We apply a larger context in predicting the effects on the economic environment (e.g., Franklin County and the towns of Swanton and Highgate), and air and water quality (e.g., Lower Missisquoi River watershed and northern Lake Champlain Basin), because those resources cannot be defined in the context of an area the size of the Missisquoi Refuge.

Certain types of actions in chapter 2 do not require additional National Environmental Policy Act (NEPA) analysis because, either individually or cumulatively, they do not significantly affect the human environment. They are "categorically excluded" from further analysis or review and this chapter does not describe their consequences further. Those excluded actions include but are not limited to the following.

- Conducting environmental education and interpretative programs; unless major construction is involved
- Conducting research, inventories, or collecting other information on refuge resources
- Operating or maintaining existing infrastructure and facilities; unless major renovation is involved;
- Conducting recurring, routine management activities;
- Developing access for the purpose of routine management or other small construction projects: e.g. fences, berms, small water control structures, interpretative kiosks;
- Planting vegetation;

- Reintroducing native plants or animals;
- Making minor changes in the amount or types of public use;
- Issuing new or revised management plans, when only minor changes are planned;
- Enforcing laws and refuge regulations

Effects on Physical Environment

Water Quality


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Natural Marsh

We evaluated and compared the management actions in the two alternatives based on their potential to maintain and enhance the water quality of the Missisquoi River Delta and the wetland habitats and open waters in the lower Missisquoi River and Missisquoi Bay. Many people and organizations in the region expressed a major concern about the degradation of water quality in the Missisquoi Bay and Missisquoi River. Three of those primary issues of water quality in the region also affect the refuge: high phosphorus loads, soil erosion leading to sedimentation downstream, and non-native, invasive species. Neither of the alternatives would violate federal or state Clean Water Act standards.

We evaluated these management actions that we predict would maintain or improve water quality.

- Expanded land conservation (including wetlands, floodplains, etc.) that would benefit water quality in the watershed by limiting land clearing and runoff
- Expanded potential for the low-level dike in Goose Bay
- Expanded partnerships in invasive species control on the refuge and in Missisquoi Bay
- Expanded cooperation among landowners and groups in the Missisquoi River watershed to improve land uses that affect water quality

We evaluated the impacts of refuge management actions with the potential of adversely affecting water quality.

- Refuge actions that may result in chemical contamination of water directly or indirectly through soil runoff
- Changes in recreational boating activities that might lead to river or bay contamination with petroleum products

Water Quality Impacts that would not vary by Alternative
Under both alternatives, the refuge would closely monitor routine management actions that have some potential to result in the chemical contamination of water directly through leakage or spills, or indirectly through soil runoff. Those

include the use of motorized watercraft and other vehicles, use of herbicides to control invasive plants, use of chemicals to deice roads and walkways, and use of soaps and detergents for cleaning vehicles and equipment. We would employ the following measures to prevent any spills or contamination, and would mitigate any contamination.

- Pouring or mixing chemicals or petroleum products would be conducted no closer than 100 feet from surface water and over a non-porous surface
- Training all staff in spill prevention and spill response
- Using approved herbicides and application methods (including rates of application and type of application) to control invasive plants and prevent or minimize non-target impacts. Our Regional Contaminants Specialist, who is responsible for upholding federal standards for water quality and soil protection, has reviewed our proposals and approved the use of chemical herbicide. Both alternatives propose that the refuge use a backpack sprayer to apply only glyphosate (Rodeo™) on Japanese knotweed, which grows on less than 1 acre
- Cleaning all refuge boats as we pull them from the water to prevent inadvertently transporting such aquatic invasive species as Eurasian water milfoil, water chestnut, and zebra mussels
- Using low- or no-phosphate soaps for cleaning refuge vehicles, boats, and equipment.

Water Quality Impacts of Alternative A
We expect some increase in water quality benefits by protecting the 8 parcels (253 acres) remaining within the existing, approved acquisition boundary in alternative A. Acquiring that land would prevent potentially damaging development that could lead to increased runoff of sediments and pollutants into tributary creeks of the Missisquoi River and Missisquoi Bay.

The refuge will continue to monitor and control invasive aquatic species under alternative A as staff resources allow. However, given the resources needed to combat that potential threat, it is unlikely that the refuge will be able to contain those species to prevent at least some degradation of water quality. In particular, we will be limited in our ability to address existing water quality issues related to the Eurasian water milfoil in Missisquoi Bay that has suppressed the native submerged aquatic vegetation (SAV) important to waterfowl. In addition to limited resources, the majority of Missisquoi Bay is off-refuge and out of Service jurisdiction.

Alternative A also limits the capacity of the refuge to work effectively with watershed landowners and other partners in addressing upstream land uses that affect the water quality of the rivers and creeks that flow through the refuge.

We do not expect the fishing and hunting activities in the Missisquoi River Delta to increase under alternative A as much as the non-consumptive uses associated with wildlife viewing, such as hiking, wildlife photography, canoeing, kayaking, and motorized boating. Nation-wide studies have shown an overall decline in the number of people interested in participating in fishing and hunting activities. Regional studies have shown the opposite trend for non-consumptive uses. Therefore, the potential for soil erosion from trails or boat launch sites near waterways and wetlands may increase slightly. Changes in the amount of motorized boating on the Missisquoi River might lead to increases in petroleum contamination in the rivers and bay.

The operation of motorized boats may affect the water clarity in the river and lake. The propeller action and wake turbulence associated with motorized boats may increase the amount of sediment particles in the water column. Nutrients stored in the sediments, such as phosphorus, could become available for algal growth. Suspended solids affect the health of fish and the settling of suspended solids can smother the eggs of fish and aquatic insects (Mitchell and Stapp 1995). Boat motors can also add various pollutants to bodies of water including metals and hydrocarbons.

Boat wakes create waves that can initiate or exacerbate shoreline erosion. When operating near shore, propeller turbulence may destabilize the bottom and erode the shoreline as well. The shoreline erosion may affect water clarity and interfere with fish use of shallow water habitat.

Plant communities may be affected directly through contact with the propeller or the boat, or indirectly through water turbidity or wave damage. Boats can also serve as a physical transport mechanism to distribute aquatic invasive species such as the zebra mussel, Eurasian water milfoil or water chestnut from an infected body of water or part of the lake to uninfected areas. Introduction of these exotics can displace native species.

To control raccoon variant of the rabies virus, the refuge uses the oral rabies vaccine. This vaccine was extensively laboratory-tested for safety in more than 50 animal species with no adverse effects regardless of route or dose. Over 50 million doses have been distributed in the U.S. since 1990 with only one case of vaccinia virus infection reported in humans (resulting in localized skin rashes) to date.

APHIS-WS currently has a national programmatic Environmental Assessment (EA) and Decision/Finding of No Significant Impact (newest supplement approved in June 2003) that analyzes the potential environmental effects of a proposal to continue and expand the involvement of APHIS-WS in cooperative ORV programs in a number of eastern states and Texas. (This document is available for inspection at the Refuge office). It was concluded that potential impacts to water resources are greatly reduced by the limited number of baits that are dropped in a specific area, the biodegradability of the vaccine liquid and baits, the high consumption rate of ORV baits by animal species, the safety and efficacy of the vaccine, and the Standard Operating Procedures that are used by participating agencies when dropping baits near a large water source.

Water Quality Impacts of Alternative B

We expect to work with partners in protecting more land (in addition to alternative A), particularly intact, fully functioning wetlands and associated riparian areas and lands including floodplain forest that are crucial for protecting water quality by preventing development and maintaining natural vegetation, thus reducing any runoff of sediment or pollutants.

We will evaluate the historical and current rates of sedimentation and changes in open water vegetation in the delta to identify a threshold for management action to address the rates of sedimentation that create a decline in water quality. Expanding the low-level dike from Goose Bay through Big Marsh Slough could create some short-term water quality issues as the dike is constructed, but we expect that it will create longer-term benefits for wetland wildlife habitat.

Alternative B will also expand the refuge inventory, monitoring, and control of nuisance, invasive, aquatic species. Controlling their spread and removing existing stands will improve water quality for native vegetation, for the wildlife

that depend on that vegetation, and for human recreation (e.g., swimming and boating).

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Visitor learning about invasive species at Visitor Contact Station

The expanded environmental education, outreach, and interpretation this alternative proposes will focus in part on greater awareness among visitors about their role in helping control the spread of invasive species to improve water quality. In addition, it proposes expanding refuge collaboration with watershed landowners and partner organizations to address and improve upstream land uses that contribute to water quality problems.

Through research partnerships, we will develop a management plan for the Maquam Bog Research Natural Area (RNA) that will include an assessment of the surface topography and hydrology of the bog to maintain the water quality and other conditions that make that bog unique.

While the impacts of motorized boating under alternative B, are similar to those under alternative A (see above), we do anticipate greater impacts under alternative B due to increased boaters. This increase in boaters will result from the enhanced visitor opportunities alternative B proposes. Alternative B will enhance refuge monitoring of the effects of boating on water quality and other refuge resources.

Soils

Most of the refuge is composed of hydric soils—poorly drained soils with high water near, at, or above the surface. The driest section is on the western boundary of the refuge along Tabor Road, encompassing the high quality grasslands, patches of upland hardwoods, and the site of the new refuge Headquarters and Visitor Contact Station. The activities that could benefit or adversely affect soils are those that either protect them from or cause erosion, compaction, or contamination. We discuss several that relate to water quality in the appropriate section of this chapter (e.g., land protection, shore erosion from boating, expanded watershed partnerships).

This section, "Soils," focuses on management actions that would either cause or alleviate the negative effects of soil compaction. Both alternatives will continue to prohibit the use of all-terrain vehicles (ATVs), which can cause serious soil disturbance, compaction, and erosion. Both alternatives also propose that we conduct habitat management activities (e.g., forest cutting, mowing, etc) at times of the year that minimize compaction or the loss of soil productivity.

Soil Impacts of Alternative A

We expect an increase in the number of people visiting the refuge each year. Most of that increase will be people stopping at the Visitor Contact Station or at Louie's Landing, thus causing few additional issues with soil compaction and disturbance. Some of that increase will result in more compaction on the interpretive trails. However, the trails are in excellent condition, and we have not had any erosion or serious compaction problems.

Significant numbers of visitors walking off established trails to collect blueberries can impact plants indirectly by compacting soils and diminishing soil porosity, aeration and nutrient availability, affecting plant growth and survival (Kuss 1986). Re-colonization of plants will be limited because root growth and penetration becomes more difficult in compacted soils (Hammitt and Cole 1998). Foot travel increases root exposure, trampling effects and crushing of plants. Plants adapted to wet or moist soils are most sensitive to disturbance from trampling effects (Kuss 1986).

In this manner, this use will cause some vegetation loss. It is anticipated, however, that under current levels of use, the incidence of these problems will be minor and insignificant. Many of the berry bushes are located right next to the trail, alleviating the need for a lot of traffic off the trail.

Although bicycling is prohibited on the refuge (except for on the gravel road between Louie's Landing and Mac's Bend), we do from time to time see unauthorized users on refuge trails. Bicycling activity is likely to have physical impacts on the soil. The existing trails on the Refuge were not constructed with this use in mind, so in order to accommodate this proposed use, trails would have to be partly re-routed, widened, and resurfaced (hardened), which would displace adjacent plant and animal life.

The shearing action of a bicycle tire damages trails. This effect is more pronounced when the ground is wet or when the land slopes up (Cessford 1995). Braking hard when traveling down slope can loosen surfaces, leading to erosion and rutting. Frequent passage by bicycles would also compact the soils, especially when conditions are wet (Cessford 1995). The compacted soils would increase water runoff and accelerate erosion. Surrounding plant communities are likely to be degraded because of loss of soil porosity, aeration and nutrients. Plant re-colonization will be limited because root growth and penetration is more difficult in compacted soils (Hammitt and Cole 1998). Plants are also directly affected by being crushed under bicycle wheels when a rider chooses or is forced to ride off-trail.

Bicycle tire tracks may increase water channeling and erosion during wet conditions. The refuge area receives over 40 inches of rainfall annually and large parts of the refuge encompass wetland communities with poorly drained soils high in organic matter. Areas with high rainfall, poor drainage and highly organic soils were identified to be most prone to trail degradation (Simmons and Cessford 1989 *in* Cessford 1995). Increased moisture content reduces the ability of the soil to support recreational traffic and plant species adapted to wet or moist habitats are highly sensitive to this traffic (Kuss 1986). Since the land on this refuge is naturally pre-disposed to erosion, bicycling activity on the trails would likely increase and accelerate degradation of the trails, thereby increasing maintenance costs. The extent of these hydrological impacts on Missisquoi trails would depend on the number of cyclists using the trails.

The only exceptions to the above impacts would be for cycling on the gravel road between Louie's Landing and Mac's Bend. That gravel roadway would require little additional maintenance and no modification to make it a suitable surface for cycling. The road is wide enough (approximately 16') that the issue of cyclists passing pedestrians or other cyclists is minimized. This road is, however, used by public and official vehicular traffic during the months of October and November, and is used by official traffic during the balance of the year. This does not constitute a particularly hazardous situation due to the roadway width, smooth surface, and relative speed of vehicles.

Soil Impacts of Alternative B
The soil impacts under alternative B are similar to alternative A (see above), with the exception of our proposed enhancement of interpretative trails. Those improvements include installing boardwalks along some wet sections. These boardwalks will help minimize compaction by limiting people walking directly on sensitive soil areas. We also propose to shorten the Jeep Trail to avoid the compaction of soil and vegetation and other disturbance in some of the more sensitive areas toward the tip of Shad Island. By shortening Jeep Trail, we are limiting public access to these areas.

Air Quality

The air quality in and around the refuge is thought to be very good. Of the six New England states, Vermont has the lowest recorded levels of ozone concentration. Its concentrations of carbon monoxide and nitrogen dioxide are far below the thresholds for those pollutants, as well.

We evaluated the management action that we predict would maintain good air quality in the area: The adoption of energy-efficient practices to reduce the refuge contribution to emissions.

We also evaluated potential adverse effects of the management alternatives on air quality.

- Vehicle and equipment emissions
- Prescribed fire

Air Quality Impacts that Would Not Vary by Alternative
The refuge management actions in neither alternative should adversely affect regional air quality. Neither would they violate federal or state Clean Air Act standards.


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Photovoltaic panels on roof of Visitor Contact Station

The refuge completed the installation of a 10-kilowatt wind turbine in 2006 at its new headquarters complex to produce electricity for its facilities and to demonstrate and promote renewable energy production. The wind power generation complements other renewable energy features of the new headquarters/Visitor Contact Station that include 4.3-kilowatt generating capacity photovoltaic panels and a geothermal cooling system. The energy produced in excess of the instantaneous needs of the facility will be routed back into the electrical grid to supply the needs of other users. We expect that to happen occasionally when the wind is strong, the sun is bright, and the facility is not open. Otherwise, the average estimated annual energy produced from the wind turbine at the new headquarters site is 7,025 kWh, or about one-third of its total demand for electrical energy. The wind turbine and its operation are nonpolluting. Using it to generate electricity will logically offset some of the pollution normally associated with electrical power production from fossil fuels. Quantifying the extent of that positive consequence is difficult, because a variety of sources, such as hydropower and coal, generate the public utility supply.

The Service limits human uses of the refuge to compatible, wildlife-oriented, consumptive and non-consumptive uses, and prohibits some uses, such as

snowmobiles and ATVs that typically would generate some air quality issues. In addition, we maintain refuge uplands, floodplains, and wetlands in natural vegetative cover, minimizing the potential anthropogenic sources of emissions that could degrade air quality.

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Refuge Grasslands

We occasionally use prescribed fire as a management tool in refuge grassland habitats. Wildfire is a minor concern on the refuge because of the expanse of its wetlands and water bodies. Both historically and at present, humans cause most wildfires that do occur. Fire can affect air quality in two ways: decreased visibility from smoke and increased particulates in the air. Good visibility and clean air are important natural resource values on the refuge. Both alternatives fully consider protecting them in fire management planning and operations.

We would comply with all applicable federal, state, and local air pollution requirements, as specified Section 118 of the Clean Air Act (42 U.S.C. 7418, as amended). In addition, further guidance can be found in the Service Fire Management Handbook. It stipulates the required conditions for prescribed fires to control their size, minimize or eliminate impacts on visibility, and reduce the potential for adding particulates and pollutants to the air. All the required conditions aim at minimizing smoke emissions by following the Best Available Control Technology. Contrary to the short-term, adverse effects on air quality resulting from our prescribed fire program, the pollution-filtering benefits derived from maintaining these areas in natural vegetation would last in perpetuity. The refuge has written a Fire Management Plan (USFWS 1987) that describes in detail these measures for minimizing the impacts of prescribed fires on air quality.

Table 4.1. Acres of grassland managed by alternative.

Acres by Alternative	A	B
Grassland managed on the refuge	338 acres	139 acres
Grassland proposed for shrubland		199 acres

Air Quality Impacts of Alternative A
In this alternative, the refuge will continue to manage 338 acres of grassland habitat, primarily using mowing after July 15 and occasionally using prescribed fire when management prescriptions require it and conditions are suitable for burning.

Alternative A would include few new ground-disturbing activities and introduce few additional emission sources.

The refuge receives 38,000 visitors a year. That includes hunters, walkers, birders, anglers, students, and boaters, among others. The refuge has limited road access open to motorized vehicles; most areas are open only to pedestrian

or boat traffic. Boats have the greatest potential for contributing to air quality issues. The use of vehicles and motorized boats by the six full-time refuge staff, one or two seasonal staff, and a handful of volunteers has a negligible effect on emissions compared to the steady traffic on Route 78, which bisects the refuge. We expect some increase in visitation under alternative A to generate a slight increase in emissions from vehicle traffic, particularly near the new visitor enter on Tabor Road.

Although the prohibition of snowmobiling is heavily enforced, refuge staff still continue to see unauthorized snowmobile activity on the refuge.

In one hour, an unregulated two-stroke snowmobile can emit as much hydrocarbon, carbon monoxide and nitrous oxide (NO_x) as 100 automobiles (EPA 2002). A snowmobile may expel 25-30% of its unburned fuel (gas and oil mix) out the tailpipe. Increases in acidity and development of lethal concentrations of nitrogen, sulfate and hydrocarbon compounds in snow are caused by air pollution at trailheads and along snowmobile trail corridors in heavy use areas.

Pollutants from snowmobile emissions, including benzene, 1,3-butadiene, Polycyclic Aromatic Hydrocarbons (PAH) and Methyl Tertiary-Butyl Ether (MTBE) become locked within the snowpack. All are classified by the U.S. Environmental Protection Agency (EPA) as known or probable human carcinogens. The toxic effects of these accumulated pollutants are magnified during the spring snowmelt (Bluewater Network). Surrounding waterways have higher acidity levels, and correspondingly higher mortality rates of aquatic insects and amphibians. The hydrocarbons and lead emitted from snowmobiles has also been determined to adversely affect brook trout (Adams 1975).

The Vermont Agency of Natural Resources states that nearly all gasoline sold in Vermont contains MTBE (VANR 2002). The amount of MTBE released from a single two-stroke snowmobile may be as much as 800 grams a day, with a significant amount incorporated into the snowpack (Einarson 2002). During the snowmelt, the dissolved MTBE enters nearby surface water and groundwater, thereby migrating further and more quickly. MTBE does not adhere to soil particles and resists biodegradation (VANR 2002). Low levels of MTBE can make drinking water supplies undrinkable due to its offensive taste and odor (EPA 1997). The EPA identifies that MTBE in drinking water at concentrations between 20 and 40 parts per billion (ppb) or below is not likely to cause adverse health effects. Vermont's ground water rules recommend a limit of 40 ppb.

The extent of the impact on environmental quality resulting from the use of snowmobiles would be contingent upon the amount of this activity on or around the refuge. Anticipated activity, while undocumented, would likely result in minimal levels of the environmental quality impacts described above.

Air Quality Impacts of Alternative B

Alternative B proposes maintaining only the highest quality grasslands that comprise 139 acres along Tabor Road. We will continue to mow them after July 15 and occasionally use prescribed fire as described under alternative A. Because we will allow 199 acres to succeed naturally to shrubland, we expect

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Cranberry Pool

a reduction in the use of prescribed fire as a management tool in grassland habitats. However, we propose to evaluate the potential role of prescribed fire in maintaining the pitch pine community in Maquam Bog. If implemented, the use of prescribed fire there would likely offset the reduced effects in the grasslands.

Alternative B proposes some ground-disturbing improvements to existing trails, such as kiosks, boardwalks, and benches, which could create dust. However, we expect to complete those projects at times when dust would be avoided or minimized. The affects on air quality from completing the headquarters and Visitor Contact Station, maintenance building, and wind turbine are similar to those in alternative A. The only variation is the proposal to develop a Backyard Habitat Demonstration Area around the Visitor Contact Station. That could create dust during the initial planting phase.

We expect an increase in visitation to 85,000 visitors under this alternative and the addition of four new staff. That will generate greater vehicle emissions, particularly near the Visitor Contact Station. However, once again we expect the effect on air quality to be minimal compared to the steady traffic on Route 78. We also expect greater boating traffic on the Missisquoi River. However, much of that increase could come from canoes, kayaks, and other non-motorized boats that generate no adverse affects on air quality.

Under alternative B, snowmobiling would continue to be prohibited on the refuge. While we hope that improved and increased outreach would result in a decrease of this activity, we still anticipate some disturbance from this activity on the refuge. Under alternative B, the impacts of snowmobiling would be the same as under alternative A.

Effects on Biological Resources

Wetlands and Open Waters in the Missisquoi River Delta

The Missisquoi River Delta is the largest wetland complex in the Lake Champlain Basin. Its protection and management, described in our first CCP goal, is the highest priority for the refuge. We evaluated the management actions in each of the alternatives for their potential to benefit or adversely affect wetland habitats in the delta, including silver maple-sensitive fern floodplain forest, lakeshore and river shore wetlands, managed wetlands, rivers and creeks, open water and bays, red maple-green ash swamp, Maquam Bog, scrub-shrub wetlands, and their associated species of conservation concern.

We evaluated the benefits of our actions to protect or restore the open water and wetland habitats or protect or enhance the breeding or migrating species of conservation concern.

- Acquisition of additional wetlands and associated riparian areas
- Control of non-native invasive aquatic species
- Manipulation of water levels in the managed wetlands (impoundments) seasonally to benefit waterfowl and marsh birds
- Control of predators that affect the functioning of dikes and water control structures and affect nesting or migratory species

We evaluated the potential for the actions under the two alternatives of adversely affecting wetlands, open water habitats, and their associated species.

- Activities of refuge visitors and boaters that might directly impact wetland habitats or disturb species of conservation concern
- Actions in habitat management that might adversely affect the biological integrity of natural plant communities

Species of conservation concern associated with wetland habitats in the Missisquoi River Delta

- Great blue heron
- Cavity-nesting ducks: wood duck, hooded merganser, common goldeneye
- Neotropical migrants: wood thrush, black-billed cuckoo, Canada warbler, rose-breasted grosbeak, orchard oriole
- Migrating waterfowl: American black duck
- Black tern
- Pied-billed grebe
- American woodcock
- Spiny softshell turtle
- Vernal pool associates: blue-spotted salamander
- Freshwater mussels: eight species
- Lake sturgeon and eastern sand darter
- Virginia chain fern, rhodora, pitch pine

Wetland and Open Water Habitat Impacts of Alternative A

Habitat Management
In alternative A, we would continue to protect the wetlands that compose 95 percent of the refuge, and pursue the protection of the remaining parcels (253 acres) that encompass wetland habitats. We would continue to work with state and federal partners in controlling nuisance, invasive, aquatic species, including Eurasian water milfoil and the recently discovered water chestnut. However, alternative A limits our ability to implement comprehensive invasive monitoring and eradication, so the likelihood is higher that some invasives would become established or spread further.

Our management efforts in the Missisquoi River Delta would continue to focus on

- monitoring the great blue heron colony, including interactions with the cormorant population,

- monitoring osprey and wood duck nest structures and boxes,
- partnering with Audubon Vermont to monitor nesting black terns,
- controlling raccoons that prey on birds,
- controlling beaver and muskrat that affect the dikes and control structures,
- monitoring the spiny softshell turtles, lake sturgeon and other aquatic life with state and federal partners, and
- creating early successional habitat to benefit American woodcock.

Water level manipulations in the impoundments to benefit nesting and migrating waterfowl and marsh birds are limited to the existing control structures and reliance on natural flooding and slow subsidence during the growing season. We would evaluate completed baseline surveys of birds to determine what additional surveys we need to guide our management and explore opportunities for engaging volunteers in assisting with additional surveys.

Wildlife Observation and Photography, Environmental Education and Interpretation
Visitor use associated with wildlife observation and photography and environmental education and interpretation can potentially damage habitats and disturb wildlife. The particularly sensitive nature of the wetland communities will be considered when managing visitor access and use.

Undesirable impacts to wildlife can result from wildlife observation and photography, particularly in the case of breeding and nesting birds, resting and roosting waterfowl, and wintering deer. Current monitoring and assessment of these uses indicate no significant disturbance is occurring. Monitoring will continue, and when needed, appropriate corrective measures will be implemented to ensure compatibility.

The use of on-site, hands-on, action-oriented activities to accomplish environmental education and interpretation objectives may impose a low-level impact on the sites used for these activities. These low-level impacts may include trampling of vegetation and temporary disturbance to wildlife species in the immediate area. Such disturbances will be of a short duration and not significant.

Off-site education held off-refuge will not create any biological impacts on the resource.

Hunting
Big game hunting is a very popular and longstanding public use on the refuge. In recent years, approximately 100 permits are sold. Prior to the institution of an annual fee for the permit, over 300 permits were issued annually. Upland game hunting is of much less interest on the refuge, primarily due to the relatively small amount of habitat available for grouse, and little interest in harvesting gray squirrels or rabbits.

The annual deer harvest in recent years falls in the low to mid-20's, including all deer harvested and reported during the Youth Weekend, the archery hunt, the regular firearms hunt, and the muzzleloader hunt. Deer frequenting the refuge move on and off the refuge to utilize neighboring sanctuary habitats and food sources, and these areas are for the most part open to hunting as well. Large portions of the refuge, however, are closed to hunters to minimize disturbance to the migratory bird resource. The Maquam Bog hunting area is physically difficult for most hunters to access and therefore see limited hunting activity.

There is seemingly no danger of reducing the deer population to unhealthy levels due to hunting on the refuge.

Migratory birds are managed on a flyway basis and hunting regulations are established in each state based on flyway data. Atlantic Flyway and State of Vermont regulations apply to the migratory waterfowl hunting program at Missisquoi. Missisquoi hunting regulations may be and, in effect, are more restrictive than state and other federal regulations by limiting hunt days, hunting hours, shotshell restrictions, etc. The numbers of birds in the flyway would be reduced, within allowable limits, as determined by State and Federal agencies. Direct disturbance to non-target birds would likely occur from hunting and associated hunter activity, but would be short term. These impacts are temporary and are mitigated by the presence of adjacent refuge habitat where hunting does not occur, and where birds can feed and rest undisturbed. Refuge regulations implementing the program ensure that periods of non-hunting disturbance are provided during the hunting season and that areas of inviolate sanctuary remain free of disturbance throughout the season.

Fishing
Bank fishing is popular in the spring. Problems associated with this activity include littering, open fires along the riverbank areas, and bank erosion.

Wildlife populations may be affected by people fishing from a boat if the boat is anchored or operates too close to nesting areas. This may lead to nest abandonment.

In late summer or fall, fishing in weed beds that provide waterfowl food can conflict with the use of the area by waterfowl.

The act of fishing and the mere presence of people in boats, whether motorized or non-motorized, can disturb and displace waterfowl, other migratory birds, and wildlife in general.

The unintentional transportation and introduction of aquatic nuisance species by fishermen moving from one water body to another with improperly cleaned and disinfected boats, motors, and trailers could have obvious negative consequences to the refuge.

Occasionally a fisherman will catch a non-target species of fish, bird, mollusk, or turtle that may be injured or killed by release attempts.

Overall, the anticipated impacts of sport fishing at Missisquoi have not been significant. Many of the impacts above are avoided, minimized or mitigated by area closures, public relations and field visits, and law enforcement patrols.

Access for Commercial Bait Collecting
There may be some general disturbance caused by the mere presence of man while crossing refuge lands to access commercial minnow collecting sites. Traditionally, however, permittees park within one hundred meters of minnow collecting sites thereby traversing on foot a short portion of refuge forested riverine habitat that is not sensitive for wildlife disturbance nor habitat damage during the period of use.

Introduction of aquatic nuisance species due to incomplete cleaning of boats and collecting equipment prior to their use at the refuge is a concern. Permittees are counseled and educated by refuge staff at the time of the issuance of the permit to properly clean their equipment and to not empty any tanks on or adjacent to refuge waterways or other waterways of the state.

Access for minnow collecting has not been shown to have any adverse impacts on the fisheries resource at the refuge, or on other species of plants and animals. Minor problems associated with littering have been addressed through Special Use Permit Conditions and an effective law enforcement program.

Furbearer Management
The impacts of furbearer management on the purposes of the refuge and mission of the Refuge System can be either direct or indirect, and may have negative, neutral, or positive impacts on refuge resources.

Indirect impacts may include displacing migratory birds during the pair bonding/nesting season or the destruction of nests by trampling. Direct impacts may include the catch of target and non-target species that are predators on migratory birds or nests, or the removal of species that induce habitat change (e.g., beavers).

Because of the temporal separation of trapping activities with breeding wildlife using the refuge, indirect impacts on those resources by trappers would be negligible. Trappers using the refuge in early March may disturb individual early nesting waterfowl on occasion, and cause their temporary displacement from specific, limited areas. Those impacts are occasional, temporary, and isolated to small geographic areas.

Indirect impacts on wildlife nesting and breeding success can result from the removal of animals under a furbearer management program. In many instances, those impacts are positive. Reductions in the populations of nest predators such as raccoon, have positive impacts on nesting birds. The degree to which predator management benefits migratory bird production can vary widely depending on the timing of the removal of predators, the size of the habitat block, habitat isolation and adjacent land use.

The removal of plant-eating species such as beaver and muskrat can have both positive and negative impacts on refuge resources. Muskrats and beavers will dig bank dens into embankments and dikes. The dens and holes in the dikes must be filled to prevent the compromise of the dike. This causes considerable damage and adds costs to the operations of the refuge. Beavers will sometimes plug water control structures, causing damage, limiting access, and compromising the capabilities of the refuge to manage habitat. Managing beaver and muskrat populations at reasonable levels through a furbearer management program can reduce refuge costs in managing wildlife.

When considering impacts on refuge purposes, the impacts of the furbearer management program obviously include those on the furbearer populations themselves. Trapping harvests and removes individuals of the species. Yet State natural resources agencies indicate that, with exceptions, furbearer populations are stable or increasing. The anticipated direct impacts of trapping on wildife would be a reduction of furbearer populations in those areas where surplus furbearers exist. The removal of excess furbearers from those areas would maintain furbearer populations at levels compatible with the habitat and with refuge objectives, minimize furbearer damage to facilities and wildlife habitat, minimize competition with or interaction among wildlife populations and species that conflict with refuge objectives, and minimize threats of disease to wildlife and humans.

Non-target furbearer species could be taken through this trapping program. Traps will be set specifically around areas of targeted species activity to reduce the risk of taking species other than targeted species. The experience of the

trappers and the selection of the appropriate trap size will reduce non-target furbearer captures (Northeast Furbearer Resources Technical Committee 1996, Boggess et. al 1990).

A national program operated under the guidance of the Fur Resources Technical Subcommittee of the International Association of Fish and Wildlife Agencies (IAFWA 1998) systematically improves the welfare of animals in trapping through trap testing and the development of "Best Management Practices (BMPs) for Trapping Furbearers in the United States." The refuge would cooperate with and contribute to the development and implementation of those BMPs by practicing an integrated, comprehensive approach to furbearer management, wherever and whenever possible.

Walking/Hiking, Cross Country Skiing, Snowshoeing
The presence of vehicles and people walking, hiking, skiing, and snowshoeing could result in some disturbance to wildlife located in habitats adjacent to the trail system. However, this disturbance should only be short term. The use of the trails could lead to soil compaction causing some tree roots to be exposed if they are close to the ground surface. The use of boardwalks and gravel surfacing is used to maintain the trails and to cover some exposed tree roots. Signs and refuge brochures advise trail users to stay on the trail to minimize effects on surrounding vegetation.

Research by non-refuge personnel
The Service encourages approved research to further the understanding of natural resources. Research by non-Service personnel adds greatly to the information base for refuge managers to make proper decisions. The disturbance of wildlife and vegetation by researchers could occur through observation, banding, collecting blood, or accessing the study area by foot, boat, or vehicle. Multiple, concurrent research projects could exacerbate those impacts. Direct mortality could result as a by-product of research activities. Overall, however, allowing non-Service personnel to conduct research should have little impact on Service interests. If researchers conduct their projects with professionalism and integrity, the knowledge gained far outweighs potential adverse impacts.

Motorized Boating
Operation of motorized boats within the refuge may disturb the wildlife using those areas. Of particular significance is the observed disruption of osprey nesting success in areas frequented by fishermen on portions of Missisquoi Refuge. The closure of these areas to all public access by the posting of "area closed" signs has resulted in a significant and dramatic increase in osprey nesting success. Likewise, motorized boats have been observed to cause turtle species (Eastern Spiny Softshell, Map, Painted) basking on logs near the mouth of the Missisquoi River to enter the water thereby disrupting their basking activity, which if done with sufficient frequency could impact reproductive success. Observations have also determined that the turtles usually reclaim their basking position within a minute of boat passage.

The operation of personal watercraft or airboats present additional disruptive considerations related to extreme noise and accessibility to areas that are shallow, narrow or otherwise normally inaccessible to other motorized boats. The highly disruptive nature of these boats to nesting, feeding or resting migratory birds make it especially important that the operators of such craft observe refuge boundaries and area closures. To date, airboat use is very infrequent, amounting to one or fewer visits per year. Personal watercraft operation is also relatively infrequent, estimated to be fewer than 10 visits per year. The later occurs

only after the water has warmed sufficiently to allow the operator to operate comfortably, normally not until mid-June.

The use of motorized boats is not expected to have a significant impact based on current levels of use and the expectation and observation that visitors are complying with postings and other regulations. Normally, when peak visitor use occurs (generally June through August), aquatic vegetation has grown significantly and lake levels lowered sufficiently to make it difficult or impossible for most visitors to enter closed areas, thereby effectively reducing or eliminating human disturbance impacts on waterfowl or other migratory birds.

The lake shoreline supports emergent vegetation, which provides some food and cover for waterfowl during the summer. If there was a high intensity of this type of use along the shoreline, it could keep waterfowl from using the shore area during the day. This may impact individual birds but is unlikely to impact populations. At the current and anticipated level of use, this impact will be slight.

Shad Island, at the northern tip of the refuge, is home to the largest great blue heron rookery in Vermont. Canoers and kayakers sometimes get too close to the rookery and may disturb nesting birds. Nest abandonment may occur if there are too many visitors getting too close to the rookery. Posting and patrol have been sufficient in recent years to curtail this activity which is much more common by motorized boaters. Likewise, non-motorized boats have been observed to cause turtle species (Eastern Spiny Softshell, Map, Painted) basking on logs near the mouth of the Missisquoi River to enter the water thereby disrupting their basking activity. If done with sufficient frequency, this could impact reproductive success. Observations have shown that non-motorized boaters have a greater disruptive impact than motorized boaters. Observations have also determined that the turtles usually reclaim their basking position within a minute of boat passage. However, this use is not expected to have a significant impact based on current levels of use and the expectation that visitors are complying with postings and other regulations.

Normally, when peak visitor use occurs (generally June through August), aquatic vegetation has grown significantly and lake levels lowered sufficiently to make it difficult or impossible for most visitors to enter closed areas, thereby effectively reducing or eliminating human disturbance impacts on waterfowl or other migratory birds.

Use of Oral Rabies Vaccine

To control raccoon variant of the rabies virus, the refuge uses the oral rabies vaccine. This vaccine was extensively laboratory-tested for safety in more than 50 animal species with no adverse effects regardless of route or dose. Rupprecht et al. (1992) reported there has been no mortality or morbidity (i.e., signs or symptoms of disease) and no lesions typical of pox virus infections caused by V-RG vaccine in over 350 individual animals representing some 20 taxonomic families of animals. They concluded that the extensive laboratory safety experiments showed V-RG to be safe in all species tested to date including raccoons, coyotes, and gray foxes. In addition, a domestic animal's annual rabies vaccination can be safely administered even if it recently ingested a dose of oral rabies vaccine. There is no possibility of vaccine-induced rabies with V-RG because the vaccine only contains the non-infective surface protein of the rabies virus; none of the viral nuclear material (i.e., RNA) which would be required for the rabies virus to replicate is present in the vaccine. The ORV program would reduce the likelihood of wildlife being exposed to the rabies virus. If threatened and endangered (T&E) species were

to come into contact with and consume an ORV bait, it would be expected that they would experience no effect other than possibly becoming immunized against rabies. Therefore, the Raboral V-RG® vaccine distributed in baits would have no adverse effects on any state or federally listed T&E species or their critical habitats.

APHIS-WS currently has a national programmatic Environmental Assessment (EA) and Decision/Finding of No Significant Impact (newest supplement approved in June 2003) that analyzes the potential environmental effects of a proposal to continue and expand the involvement of APHIS-WS in cooperative ORV programs in a number of eastern states and Texas. (This document is available for inspection at the Refuge office). The following conclusions were made concerning issues analyzed in detail in the EA.

- The short-term duration, infrequency, and negligible intensity of flights over any given area, in addition to the tolerance of wildlife of such activity, would have a negligible adverse environmental impact on wildlife as a result of ORV program overflights.

- Potential impacts to water resources are greatly reduced by the limited number of baits that are dropped in a specific area, the biodegradability of the vaccine liquid and baits, the high consumption rate of ORV baits by animal species, the safety and efficacy of the vaccine, and the Standard Operating Procedures that are used by participating agencies when dropping baits near a large water source.

- No adverse impacts to target species are anticipated. Beneficial impacts may occur from immunizing target species against rabies.

- No adverse impacts to nontargets, including threatened and endangered (T&E) species are anticipated. Potential minor beneficial impacts may occur by possibly immunizing nontarget wildlife species against rabies.

- No adverse impacts to domestic animals are anticipated. Potential minor beneficial impacts may occur by possibly immunizing domestic animals against rabies.

- Negligible risk is anticipated for the recombined V-RG virus to "revert to virulence" and result in a virus that could cause disease in humans or animals.

- Negligible risk is anticipated for the V-RG virus to recombine with other viruses in the wild to form new viruses that could cause disease in humans or animals.

- Negligible risk is anticipated for aerially dropped baits to strike and injure people or domestic animals.

Snowmobiling
Although the refuge continues to enforce the prohibition of snowmobiles on the refuge, they continue to see a number of unauthorized snowmobiles on/off refuge trails. Snowmobiles have less obvious effects on larger animals, moderate effects on medium-sized animals and drastic effects on small animals, notably those overwintering in sub-snow environments (Bury 1978). Deer are known to be tolerant of the noise produced by snowmobiles and are not seriously effected by the physical impacts (snow compaction) of snowmobiles, although the snowmobile path can provide easier access for predators to deer yarding locations thus producing an indirect impact.

Snowmobile use is likely to impact the small animals that live in the subnivean layer (the space between snow and soil) during the winter time. Jarvinen and Schmid (1971) found marked increases in winter mortality of small mammals underneath snowmobile-compacted snowfields. The snowmobiles compact the snow, destroying air spaces between the snow and soil, reduce snow depth, increase the density of the snow, and decrease snow insulation of the small subnivean air space. The air in the subnivean layer may also become toxic with unusually high amounts of carbon monoxide emitted from snowmobile exhaust (Neumann and Merriam 1972).

The noise produced by snowmobiles may alarm some wintering wildlife and cause them to avoid searching for food near snowmobile trails. The Bureau of Land Management found that the most significant impact of snowmobiles on wildlife appears to be changes in the animals' daily routine rather than direct mortality.

As stated above, toxins emitted from the snowmobiles build up in the snowpack and are released into waterways during spring snowmelt, potentially and probably impacting fish, amphibians and aquatic insects.

Alternative A provides limited opportunity to adequately monitor the affects of recreational users, such as boaters, or enforce violations to protect wetland habitats and associated species. We would continue to post "no-disturbance" or "area closed" signs in sensitive areas or in certain seasons, and continue to rely on the Coast Guard, Homeland Security, the Vermont State Police, and the Vermont Fish and Wildlife Department to provide law enforcement within the limits of their authority on the refuge.

Wetland and Open Water Habitat Impacts of Alternative B
In addition to pursuing the protection of the remaining parcels (253 acres) within the refuge that encompass wetland habitats, we would work with partners to protect additional key areas that protect intact, fully functioning wetland and associated riparian areas, including floodplain forests. That would greatly enhance the protection of refuge wetlands by preventing development that could lead to erosion and runoff, further degrading habitats downstream.

Alternative B would enable greater focus and effort on the inventory, monitoring, and control of nuisance invasive aquatic species, identified as one of the major management concerns in the Lake Champlain Basin. We propose to develop a Geographic Information System (GIS) database to track invasive species distribution and control. Using that system, we would inventory and map the distribution of SAV, which is critical to thousands of migrating waterfowl, and implement actions to maintain and restore those native beds while reducing the invasive species.

We recommend the removal of Shad Island from the proposed wilderness designation pending in Congress since 1974. We believe that surrounding landscape conditions have changed since we first proposed the area for designation, and it no longer meets the criteria. Instead, we propose to develop a management plan for the Shad Island RNA (designated in 1968) to guide the management and research of this unique floodplain forest (and site of the heron rookery) at the tip of the constantly shifting Missisquoi River Delta. That includes collaborating with researchers to monitor cormorant affects on floodplain forest habitat and identify a population threshold for controlling cormorants to protect the habitat.

In this alternative, we would shift energy away from erecting and maintaining artificial nest structures (e.g., wood duck boxes and osprey platforms) toward

inventorying and relying on natural cavities and structures. That would free staff to focus on evaluating existing baseline survey data and identifying and implementing wildlife and plant surveys that can guide future habitat protection and management. Those would include expanded surveys of aquatic resources, including spiny softshell turtles, rare freshwater mussels, lake sturgeon, eastern sand darter and other rare fish. In addition, we would evaluate our predator control program to ensure that we are targeting the individuals that adversely affect the integrity of the impoundments and rare species.

We would also use the GIS system to evaluate and track our annual habitat management activities. Alternative B proposes greater collaborations among refuge, state, federal, and university researchers and managers to help guide our management to benefit species of conservation concern. Specifically, that would include an ecological assessment of the impoundments to determine the need for expanding the dikes or other habitat manipulations, an ecological assessment of the red maple-green ash swamp natural community, and studying the hydrology, topography and fire history of Maquam Bog to ensure the protection of the biological diversity in that unique peatland.

Under alternative B, the impacts from public use are similar to those under alternative A (see above). This alternative provides a much greater opportunity to engage visitors, including boaters, birders, anglers and hunters, in protecting the wetland habitats in the Missisquoi delta. We would engage these recreational users by providing more interpretive information at boat launches, on kiosks, in our outreach to the media, local businesses and tour guides, and at our Visitor Contact Station. Our proposed, expanded staff, specifically, a law enforcement position, would provide much-needed oversight of the behavior and affects of recreational users on and near the refuge. That is crucial, as we anticipate an increase in visitation, and more people explore the rivers, creeks, and bays on the refuge.

Upland Habitats: Dry Oak Upland Forest, Northern Hardwood Forest, Grassland

Although the uplands compose only about 5 percent of the refuge, they host a diverse array of wildlife, and typically require more management to maintain the habitat conditions needed for a suite of species of conservation concern. That includes using mechanized equipment (e.g., Hydroax, Brontosaurus) to create early successional habitat in a portion of the northern hardwood forest, and mowing or using prescribed fire to maintain grasslands.

For both alternatives, we evaluated our proposed management actions that would benefit or adversely affect upland habitats and their associated species.

- Managing actively to create early successional habitat and maintain grasslands
- Shifting some grassland management to shrubland or floodplain forest
- Acquiring additional upland habitats
- Operation of wind turbine

Upland Habitat Impacts of Alternative A

Habitat Management
Alternative A proposes we continue to manage 20 acres of the northern hardwood forest around the Stephen J. Young marsh and 60 acres in the red maple-green ash swamp (see "Wetlands," above) and its associated field using a hydroax, brontosaurus, or chain saw to create early successional habitat for American woodcock. We would conduct spring singing counts in those areas to assess the response of woodcock to those management activities.


USFWS

Clearing for woodcock

We would continue to mow the 338 acres of grasslands along Tabor Road and along the Missisquoi River/Route 78 corridor after July 15 to benefit grassland-nesting birds, particularly bobolinks and eastern meadowlarks. The Tabor Road grasslands support a diverse grassland bird population. However, the grasslands along the Missisquoi River corridor are not known to support any grassland nesting birds. The expenditure of staff time and resources on those grasslands is not necessarily meeting the objectives for this habitat condition.

The only additional land acquisition this alternative proposes are those uplands contained in the remaining parcels (253 acres) within the existing, approved acquisition boundary.

Impacts to birds and bats from the operation of the wind turbine are expected to be minimal at Missisquoi due to planning, site selection and pre-construction monitoring. Design elements to avoid or minimize wildlife impacts include using a single tower with no guy wires or lights and a construction site that had been disturbed by agriculture, mowing, or burning since the 1960's. The turbine is small, just slightly larger than the farm, ranch or pasture windmills that wer once common in our country. The Refuge Manager prepared an EA for the project, which included evaluating potential impacts to migratory birds and the endangered Indiana Bat. Surveys for Indiana Bats in 2004 and 2005 did not detect this species at the site. The Refuge Manager also applied for a Certificate of Public Good from the Vermont Public Service Board for connecting the turbine to the grid. To test assumptions regarding impacts to birds and bats, post construction monitoring will be conducted at Missisquoi.

Wildlife Observation and Photography, Environmental Education and Interpretation

Visitor use associated with wildlife observation and photography and environmental education and interpretation can potentially damage habitats and disturb wildlife. The particularly sensitive nature of the wetland communities will be considered when managing visitor access and use.

Undesirable impacts to wildlife can result from wildlife observation and photography, particularly in the case of breeding and nesting birds, resting and roosting waterfowl, and wintering deer. Current monitoring and assessment of these uses indicate no significant disturbance is occurring. Monitoring will continue, and when needed, appropriate corrective measures will be implemented to ensure compatibility.

The use of on-site, hands-on, action-oriented activities to accomplish environmental education and interpretation objectives may impose a low-level impact on the sites used for these activities. These low-level impacts may include trampling of vegetation and temporary disturbance to wildlife species in the immediate area. Such disturbances will be of a short duration and not significant.

Off-site education held off-refuge will not create any biological impacts on the resource.

Hunting
Big game hunting is a very popular and longstanding public use on the refuge. In recent years, approximately 100 permits are sold. Prior to the institution of an annual fee for the permit, over 300 permits were issued annually. Upland game hunting is of much less interest on the refuge, primarily due to the relatively small amount of habitat available for grouse, and little interest in harvesting gray squirrels or rabbits.

The annual deer harvest in recent years falls in the low to mid-20's, including all deer harvested and reported during the Youth Weekend, the archery hunt, the regular firearms hunt, and the muzzleloader hunt. Deer frequenting the refuge move on and off the refuge to utilize neighboring sanctuary habitats and food sources, and these areas are for the most part open to hunting as well. Large portions of the refuge, however, are closed to hunters to minimize disturbance to the migratory bird resource. The Maquam Bog hunting area is physically difficult for most hunters to access and therefore see limited hunting activity. There is seemingly no danger of reducing the deer population to unhealthy levels due to hunting on the refuge.

Migratory birds are managed on a flyway basis and hunting regulations are established in each state based on flyway data. Atlantic Flyway and State of Vermont regulations apply to the migratory waterfowl hunting program at Missisquoi. Missisquoi hunting regulations may be and, in effect, are more restrictive than state and other federal regulations by limiting hunt days, hunting hours, shotshell restrictions, etc. The numbers of birds in the flyway would be reduced, within allowable limits, as determined by State and Federal agencies. Direct disturbance to non-target birds would likely occur from hunting and associated hunter activity, but would be short term. These impacts are temporary and are mitigated by the presence of adjacent refuge habitat where hunting does not occur, and where birds can feed and rest undisturbed. Refuge regulations implementing the program ensure that periods of non-hunting disturbance are provided during the hunting season and that areas of inviolate sanctuary remain free of disturbance throughout the season.

Walking/Hiking, Cross Country Skiing, Snowshoeing
The presence of vehicles and people walking, hiking, skiing, and snowshoeing could result in some disturbance to wildlife located in habitats adjacent to the trail system. However, this disturbance should only be short term. The use of the trails could lead to soil compaction causing some tree roots to be exposed if they are close to the ground surface. The use of boardwalks and gravel surfacing is used to maintain the trails and to cover some exposed tree roots. Signs and refuge brochures advise trail users to stay on the trail to minimize effects on surrounding vegetation.

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As stated above, toxins emitted from the snowmobiles build up in the snowpack and are released into waterways during spring snowmelt, potentially and probably impacting fish, amphibians and aquatic insects.

Upland Habitat Impacts of Alternative B
In this alternative, we will continue to maintain the early successional habitats described in alternative A. We would evaluate and modify, as needed, the management prescriptions to create quality habitat for woodcock and other species that benefit from that habitat condition, including ruffed grouse and migrating songbirds. We would establish more rigorous woodcock singing-ground surveys, to monitor their response to the changes in habitat.

We would shift our management of a suite of small grasslands unproductive for grassland birds along the Missisquoi River corridor to shrubland through natural succession. Then, we would evaluate that shrubland to determine if we should allow it to continue its natural succession toward floodplain forest. That would create a large block of floodplain forest along the river, one of the most important habitats on the refuge. We would continue to manage 139 acres of grassland along Tabor Road, and allow 199 acres to revert to shrubland.

We would pursue opportunities (e.g., interested landowners, funding sources), as they present themselves, to acquire upland habitats: specifically, those that would further protect a large, unfragmented block of habitat, such as those along Tabor Road).

Under alternative B, the impacts from public use activities are the same as under alternative A (see above).

Effects on Public Use

In evaluating the impacts on public use from implementing the two alternatives, we considered:

1) the issues identified during public scoping (Chapter 1, Purpose and Need);
2) the management issues we identify in our description of current public use programs (Chapter 3, Affected Environment); and,
3) our experience with, and knowledge of, who would be affected by the changes we propose to undertake under alternative B (Chapter 2, Alternatives).

Many of the individuals who commented during public scoping mentioned that public use was their most important refuge issue; however, their reasons varied. Some people expressed concern that areas of the refuge are being or will be overused by too many visitors, and that wildlife are being or will be negatively impacted. Unfortunately, most of these comments were not site-specific and are difficult to address directly. Others specifically recommended that we should implement more closures around sensitive nesting areas. Several individuals, who want to participate in wildlife viewing and photography, feel areas of the refuge are effectively "off-limits" to them during the hunting season, even though the trails are not officially closed by the refuge. They did not necessarily believe that hunting should take precedence over the other priority public use programs. This is the primary conflict between the various public uses that was identified by the public.

Other people requested more guided programs and walks, and additional infrastructure to facilitate wildlife viewing and photography. A few people requested accessible opportunities to accommodate people with disabilities.

Most people who commented sought additional opportunities for hunting and fishing. These individuals were primarily seeking new and improved access to hunting and fishing areas. Except for those comments, most people seemed generally satisfied with how the current refuge hunting and fishing programs are managed.

Early in the planning process, we identified several public use management issues of concern to our staff. Unauthorized use of snowmobiles is a significant concern throughout the winter. The refuge is officially closed to snowmobiling. The only authorized use is for administrative purposes. However, we often find snowmobile tracks, evidence of unauthorized use, in sensitive areas, making this one of our most important law enforcement issues. Other unauthorized activities that require our attention include use of ATVs, littering, vandalism to kiosks and restrooms, biking on trails, walking dogs off-leash, camping and campfires, and trespassing in closed areas.

Visitor Numbers

Refuge Visitation Impacts of Alternative A

We estimate our current visitation is 38,000 visitors, although this figure is increasing for a couple of reasons. We have recently completed construction of a new headquarters office and visitor contact station. It has become a regional destination for many because the facility, our programs, and the trails we provide are not otherwise offered in the area as a free public opportunity. Our plans to complete the Discovery Trail near this facility, and an outdoor classroom, are expected to be very popular. The Discovery Trail will be fully accessible and comply with ADA requirements and standards. This will be our only trail that

is fully ADA compliant. Visitation to the refuge is also increasing since it is now part of two regional trails: the Lake Champlain Birding Trail and the Northern Forest Canoe Trail.

It is our opinion that the amount of current and projected visitation is well within our capacity to manage, and within the capacity of the resources to support it. Much of the increase we expect over the next 15 years would be associated with groups attending programs at our visitor facility. These visitors would be participating in a program of our design, which includes being in areas that we have determined can accommodate the use. In addition, we have observed that the vast majority of visitors stay within the footprint of our trails and respect closed areas. We see very little erosion or compaction or other resource degradation from overuse. The little that we do see is at trailheads and boat landings, where it occurs in a fairly small area (1/10 acre) and is not likely to expand.

Public Use Activities

Wildlife Observation and Photography, Environmental Education, and Interpretation Impacts of Alternative A

Although one negative impact of wildlife observation, photography, environmental education and photography could include potential conflicts among user groups, this impact is typically quite minimal. The only activities where we see consistent conflict are with wildlife observation and photography, and hunting (see above). Logically, this conflict is most common during the hunting season.

We are not proposing to change our trail capacity under alternative A, except to complete the Discovery Trail. We would continue to maintain the 6 existing trails that provide opportunities for wildlife observation and photography. The trails would remain open year round, sunrise to sunset. Visitors would continue to decide on their own whether or not to use trails during the hunt season. The Black Creek/Maquam Creek Trail is entirely contained within a posted safety zone. The other trails are not.

As we mentioned, some people engaged in these activities are impacted by our hunting program, since they will not use the area during the hunting season. This conflict would remain under alternative A during the typical hunt seasons (periodically October – December). This time of year our visitation is at its lowest as peak bird migrations are over and fall foliage is past. So, during the hunt season, fewer people engaged in these four activities would be displaced.

It has been our concern that we are unable to meet all the requests that we receive for environmental and interpretive programs. We simply do not have the staff or resources to implement all the requests. While our new facility and infrastructure provides a focal point and enhances support for our programs, we expect that it would still be difficult for us to fulfill all the requests for programs.

Hunting Impacts of Alternative A

In recent years, a conflict has arisen among hunters utilizing the delta portion of the refuge. These areas are generally long and narrow or relatively small islands, which cannot tolerate many hunters without impacting the natural movement of wildlife. This, therefore, decreases the quality of the hunting experience and creates some level of competition between hunters. This has manifested itself most visibly in two ways:

1) Hunters can erect portable tree stands, with the signature of the refuge manager on their permit, on the east side of the Missisquoi River in the open hunting area. Competition among hunters for choice sites is keen and has led to unethical behavior. Hunters consider the area in the vicinity of their stand to be their exclusive hunting area, in spite of refuge regulations specifically stating this is not the case.

2) During the Youth Weekend hunt and the muzzleloader season, several parties of local hunters have established the practice of organizing drives on these long and narrow portions of the open area and on Metcalfe and Shad Islands. While fairly successful for hunters in the organized group, this method ruins the chances of success for other hunters not associated with the group and again leads to unethical behavior.

We would continue to outreach to hunters about our regulations, but this conflict is likely to continue under alternative A.

Waterfowl hunter activity has little impact on other refuge visitors with the exception of those who wish to use the Jeep Trail for walking to observe and photograph wildlife. Non-hunters are impacted by the presence and noise associated with waterfowl hunting on the delta and especially in the Long Marsh Channel and, to a lesser extent, Long Marsh Bay. Paddlers, other boaters and fishermen can also be impacted by the activity associated with waterfowl hunting, although participation in these types of uses is generally diminishing as the season for these uses comes to a close. An exception we are seeing in recent years, however, is that interest in bass fishing in particular is extending later in the year and into the waterfowl hunting season. This is a result of a tremendous increase in the number of fishing tournaments on Lake Champlain and the "discovery" of the refuge and its adjacent water as a "hot spot". We are seeing increasing conflicts between fishermen and waterfowl hunters in October and into November. Otherwise, the length of the boating season is largely weather dependent.

Fishing Impacts of Alternative A
Bank fishing is popular in the spring. The problems associated with that activity include littering, open fires along the riverbank areas, and bank erosion. Overall, the anticipated impacts of sport fishing have not been significant. Area closures, public relations and field visits, and law enforcement patrols minimize or mitigate many impacts.

Dog Walking Impacts of Alternative A
Under current management, dogs are allowed on the refuge, but must be kept under control on a leash of no longer than 10 feet. Over the years, refuge staff and volunteers have observed many visitors violating that regulation. Many of them are repeat offenders. Problems of unleashed dogs encountered on the refuge include lost dogs, other hikers and their dogs intimidated by unleashed dogs, visitor disgust with waste left on refuge trails, thus depriving them of a peaceful visit, harassment and injury to wildlife, and interference with refuge management activities such as trapping.

Activities Prohibited on the Refuge Impacts of Alternative A
Although bicycling is prohibited on the refuge (except for seasonally on the gravel road between Louie's Landing and Mac's Bend), we do from time to time see

unauthorized users on refuge trails. Existing refuge trails were developed for pedestrian use, and while portions of some of the trails are wide to accommodate handicapped accessibility, they are otherwise ill-suited for concurrent pedestrian and cyclist use. Under alternative A, we would continue to enforce against bicycling where it is not allowed.

Safe bicycle passage is further jeopardized by dogs on leashes in the company of pedestrians. Unless the pedestrian exercises close control of the dog, it may easily obstruct the path of the cyclist, or dart into the path with little or no warning, potentially causing injury to all involved. A similar concern exists for children, even when in the company of adult supervisors. Their generally less mature judgment may not incite them to give way to avoid contact, or they simply may not be paying attention to or realize the potential hazards of cyclists using the trail.

In summary, since we do not want to compromise the safety of pedestrians, we do not allow bicycling with the exception mentioned below.

Bicycling would continue to be allowed seasonally on the gravel road between Louie's Landing and Mac's Bend. The road is wide enough (approximately 16') that the issue of cyclists passing pedestrians or other cyclists is minimized. This road is used by public and official vehicular traffic during the months of October and November, and is used by official traffic during the balance of the year. However, bicycle use does not constitute a particularly hazardous situation due to the roadway width, smooth surface, and speed limit for vehicles. And it is logical to conclude that if we allow motor vehicles to use the road, we can likewise allow bicycles to use the road.

Snowmobiling is another activity that is not allowed on the refuge. Although the prohibition of this activity is heavily enforced, refuge staff still continue to see unauthorized snowmobile activity on the refuge. Conflicts may arise between snowmobile users and other users when the two uses converge.

Conflicts with other users are often asymmetric. Cross-country skiers and snowshoers tend to feel a conflict with snowmobilers because the noise from snowmobiles disturbs their solitude and quiet while visiting the refuge. Likewise, they have been known to complain about the smell of fuel emissions from the machines. In these situations, conflict comes about because the motivations for participation of the pedestrian users are compromised and anticipated experiences are unfulfilled (Jackson and Wong 1982). Snowmobilers, on the other hand, may be tolerant or indifferent of the pedestrian users.

Safety problems may also occur where differing uses coincide, especially on a trail that was not designed for use by snowmobiles and thus may be narrow, winding, and otherwise offer poor visibility for what lies immediately ahead. Snowmobile users may collide with other users who are snowshoeing or cross-country skiing on the trails. Snowmobilers may collide with other snowmobilers or stationary trailside features such as trees, rocks, and signs, resulting in injury or death and property damage. The U.S. Consumer Product Safety Commission states that an average of 13,400 snowmobile-related injuries were treated in U.S. hospital emergency rooms from 1990 – 1996. Finally, depending on the number of snowmobiles in use, snowmobilers and other users may be exposed to significant levels of carbon monoxide from snowmobile exhaust emissions and risk carbon monoxide poisoning.

Visitor Numbers

Refuge Visitation Impacts of Alternative B
We estimate that our visitation will increase to 85,000 visitors based on the reasons we identified under alternative A. As we described, this increase in visitation would primarily result from the regional attraction of the Visitor Contact Station, as well as the refuge being identified in the Lake Champlain Birding Trail and the Northern Forest Canoe Trail. The new VCS would not only allow the staff to better accommodate general visitation but more specifically equip the staff to host various schools and other groups for environmental education programs. Since refuge visitors would continue to stay in the same areas of the refuge (VCS, designated trails) the increase in visitation would not cause any additional habitat degradation or wildlife disturbance. We do not expect new visitors to distribute over a wider area of the refuge and increase the footprint they leave on the refuge.

Wildlife Observation and Photography, Environmental Education and Interpretation Impacts of Alternative B
We do not expect any increase in the amount of conflicts among users engaged in wildlife observation, photography, environmental education and interpretation, under alternative B. As we described under alternative A, many visitors interested in wildlife observation and photography will avoid areas where hunting is occurring and express concern about being displaced from their activity. We have observed it is particularly disconcerting to those visitors who are not aware that hunting is ongoing until they arrive at the refuge and/or they observe hunting in the field. This encounter affects the quality of their experience. Under alternative B, we have decided to implement certain area closures and trail advisories during the hunting season as noted below.

We would continue to upset some late fall visitors who would be displaced by hunting. However, we hope to reduce the level of concern and inconvenience to visitors who may not be aware that hunting is in progress until they arrive at the refuge by increased outreach, postings, and distribution of literature. In our judgment, the greatest impact is to those visitors who were previously willing to hike the trails during the hunt season and would be restricted during certain seasons under alternative B.

- Implement the following trail closures (trails would be posted as “Closed”)
  - Jeep Trail
    - Youth Deer Hunt Weekend (Early November–2 days)
    - Muzzleloader Season (Early December – 10 days)
  - Discovery Trail
    - Regular Season – shotgun and rifle (Mid-November–16 days)
    - Youth Deer Hunt Weekend
    - Muzzleloader Season
  - Old Railroad Trail
    - Regular Season – shotgun and rifle
    - Youth Deer Hunt Weekend
    - Muzzleloader Season
  - Stephen J. Young Marsh Trail
    - Regular Season – shotgun and rifle
    - Youth Deer Hunt Weekend
    - Muzzleloader Season

- Implement the following trail advisories (Trails would be posted to advise hikers and users that the area is open to hunting—visitors may proceed with caution)

  - Discovery Trail
    - Archery Season (Early October – 23 days)
    - Upland Game Seasons (includes gray squirrel, rabbit and hare, ruffed grouse)

  - Old Railroad Trail
    - Archery Season
    - Upland Game Seasons (includes gray squirrel, rabbit and hare, ruffed grouse)

  - Stephen J. Young Marsh Trail
    - Archery Season
    - Upland Game Seasons (includes gray squirrel, rabbit and hare, ruffed grouse)

We are primarily implementing these closures and advisories to maximize the quality of the hunting experience. Hunting and fishing have regionally been identified as the top two Areas of Emphasis for priority public use programs on the refuge. These two activities will be particularly emphasized in the wise use of staffing and funding resources and management to reduce conflict.

In addition to the trail closures and advisories mentioned above, we are proposing to shorten the Jeep trail under alternative B. The trail would be shortened to end where the trail is close to the river. A bench would be placed there to identify the end of the trail. While we understand that the shortening of this trail might affect the experience of visitors engaged in wildlife observation and photography, our obligation is to wildlife as stated in the mission of the Service. By shortening the trail we would minimize the number of people and therefore the amount of disturbance that is taking place in one of our sensitive nesting areas. Since we are only closing a small portion of the trail, we expect minimal impact on visitor experience.

Under current management we identified our inability to meet all the requests that we receive for environmental education and interpretative programs. Under alternative B, we propose the hiring of an additional visitor services employee. This, in addition to our new visitor contact station, would improve and enhance our ability to meet the demand for these programs, but would by no means ensure that we meet all requests for environmental education and interpretative programs on the refuge. While we might not be able to meet all requests for programs being hosted at our facility, our strategy is to work with teachers to develop curriculum and implement programs to help facilitate environmental education opportunities on and off the refuge.

Hunting Impacts of Alternative B
To resolve any concerns associated with access and distribution of hunters within hunting areas and to provide enhanced opportunities for youth, the disabled and seniors, the refuge manager would evaluate the effectiveness of instituting a lottery permit system for deer hunting on the delta (including both sides of the river), and would seek opportunities to develop hunting programs for juniors, seniors, and disabled big game hunters, in these and other refuge areas. This would reduce the total number of hunters at the delta portion of the refuge, thereby improving the quality of the hunting experience and reducing the level of competition among hunters. By offering more opportunities for juniors, seniors and disabled big game hunters we would minimize the unethical behavior that degrades the hunting experience for other hunters.

Under alternative B, the refuge is proposing to discontinue woodcock and snipe hunting in the delta lakeshore area due to the lack of birds utilizing that habitat type as well as the ecological sensitivity of the area. We are proposing to open the Stephen J. Young Marsh area, west of Tabor Road to woodcock and snipe hunting since this area supports early successional species (including woodcock and snipe) at harvestable levels. This proposal to change where woodcock and snipe hunting are allowed would not only improve the quality of the experience for hunters but also minimize hunter impacts in a more ecologically sensitive area (delta lakeshore area).

The impacts of waterfowl hunting under alternative B are similar to those under alternative A (see above) with the exception that our addition of 2-5 new waterfowl blinds would provide additional capacity for this popular means of hunting waterfowl.

Fishing Impacts of Alternative B
The impacts of fishing under alternative B are similar to those under alternative A (see above).

Cross Country Skiing, Snowshoeing Impacts of Alternative B
The impacts of cross country skiing, snowshoeing under alternative B are similar to those under alternative A (see above under Activities Prohibited on the Refuge).

Dog Walking Impacts of Alternative B
Under alternative B we are proposing a "no dogs" policy to protect sensitive habitats, wildlife, and visitors from dogs running loose. While we understand that not everyone is violating the 10 foot leash regulation, in our field observations the majority of dog-walkers are. We must consider the safety of wildlife and the quality of experience refuge visitors are receiving as our primary consideration. While we could lessen impacts by increasing law enforcement efforts on the leash regulation, this would require us to dedicate considerable personnel time to enforcing an activity that does not support one of our priority public uses. This additional expenditure of resources would negatively impact our ability to meet refuge goals and objectives.

Activities Prohibited on the Refuge Impacts of Alternative B
Under alternative B, bicycling (with the exception of the gravel road between Louie's Landing and Mac's Bend) and snowmobiling would continue to be prohibited on the refuge. While we hope that improved and increased outreach would result in a decrease of these activities, we still anticipate some disturbance from these activities on the refuge. Under alternative B, the impacts and conflicts of bicycling and snowmobiling would be the same as under alternative A.

Effects on Cultural Resources

Archaeological and Historic Resources

The refuge and the area surrounding it have great historical and cultural importance. Surveys on the refuge have documented 34 known archaeological sites: some prehistoric, others historic farmsteads. More than 50,000 archaeological artifacts found on the refuge are stored at the University of Maine (UMaine) at Farmington and at the University of Vermont (UVM). Given the dispersed location of their repositories, the artifacts are not readily available for research or interpretation. The local Abenaki Nation of Missisquoi tribe is working to protect any known historical sites that represent their heritage.

We evaluated the potential beneficial and adverse effects of our management action under the two alternatives.

- Habitat management or public uses that might affect the stability of still unearthed artifacts

- Cultural resource interpretive displays and programs at the Visitor Contact Station

Archaeological and Historical Resource Impacts of Alternative A
Under this alternative, we would continue to work cooperatively with the local Abenaki Nation of Missisquoi tribe to identify and protect known sites of spiritual or historical importance to this community as we conduct our habitat management activities. Our new Visitor Contact Station would continue to incorporate interpretive displays on cultural resources as new information becomes available. We would comply with the Archaeological Resources Protection Act, the Native American Graves Protection & Repatriation Act, and the National Historic Preservation Act. However, this alternative limits our law enforcement capabilities to patrol and protect known and suspected archaeological sites.

Archaeological and Historical Resource Impacts of Alternative B
Alternative B greatly expands proactive opportunities to protect cultural resources on the refuge. We would conduct a cultural resources overview, monitor bank erosion along the Missisquoi River in anticipation of unearthing artifacts, and develop a cultural resources management plan to ensure greater protection and interpretation of these resources. This alternative proposes we engage more volunteers, including the Abenaki Nation of Missisquoi community, in identifying and monitoring sensitive areas. It also expands opportunities for research and interpretation of the known cultural resources, providing greater awareness and stewardship of those resources in the region.

Given the range of artifacts and known archaeological sites and the shifting nature of the Missisquoi River Delta, cultural resources could be damaged or lost without our knowledge. We would minimize that potential for loss by consulting with our cultural resources staff before any ground-disturbing activities such as constructing boardwalks kiosks, or any work with the dikes or water control structures. In addition, hiring a law enforcement officer would provide much-needed patrol and enhance the protection of known or suspected sites.

USFWS

Refuge visitor looking at Visitor Contact Station exhibit

Effects on Special Designation Areas

Introduction

Lands within individual national wildlife refuges may be recognized with additional or special designations. The influence that the special designations may have on the management of refuge lands and waters may vary considerably. Wilderness and Research Natural Areas are the two types of special designation areas found within Missisquoi National Wildlife Refuge.

Wilderness, as defined by the Wilderness Act, is an area untrammeled (free from man's control), undeveloped, natural, and offers outstanding opportunities for solitude or primitive recreation. The National Wildlife Refuge System manages

refuge wilderness to secure an enduring resource of wilderness and to accomplish refuge purposes in a way that preserves wilderness character.

Research Natural Areas are part of a national network of reserved lands which are intended to represent the full array of North American ecosystems with their biological communities, habitats, natural phenomena, and geological and hydrological formations.

In Research Natural Areas, as in designated wilderness, natural processes are allowed to predominate without human intervention. Under certain circumstances, deliberate manipulation may be used to maintain the unique features for which the research natural area was established.

Activities such as hiking, bird watching, hunting, fishing, wildlife observation, and photography are permissible, but not mandated, in research natural areas. Research natural areas may be closed to all public use if such use is determined to be incompatible with primary refuge purposes.

This section describes the environmental effects involved in implementing the special designation areas alternatives found in Chapter 2. Alternative A, "Current Management," continues our current management of the Shad Island proposed Wilderness as Wilderness, and both Shad Island and Maquam Bog as Research Natural Areas. Alternative B would develop a management plan for Shad Island Research Natural Area and recommend removal of Shad Island from proposed Wilderness designation status. Alternative B proposes to withdraw Service support for pursuing Wilderness designation because the area no longer fulfills either the purpose or intent of the Wilderness Act.

We described earlier in chapter 4 the physical, biological, cultural resource, social and economic impacts associated with fully implementing all programs under alternatives A and B.

The following information focuses on the potential direct and indirect effects that implementing our alternatives for special designation areas will have on the physical, biological, cultural resource and socioeconomic environment beyond what has already been described elsewhere in chapter 4.

Physical Environment

Water Quality

Water Quality Impacts of Alternative A and B

There would be no expected change to the water quality by implementing either alternative. The natural functions of the watershed would be maintained. Potential impacts to the watershed would be limited to local recreational and community activities. Water quality would fluctuate within ranges defined by natural processes.

Soils

Soils Impacts of Alternative A

There would be no expected change to the soils by continuing the current management alternative.

Soils Impacts of Alternative B

Soil productivity could be reduced if the areas were open to increased or sustained public use. The expected effects would include increased soil compaction, displacement, and erosion. The refuge dike and water control structure rehabilitation efforts will also continue to increase the amount of soil compaction, which has the potential to adversely effect the areas riparian and nutrient cycles.

Air Quality

Air Quality Impacts of Alternative A and B

There would be no expected net change to the air quality, by implementing either alternative. Wildland fires could result in short term degradation of the air quality. Prescribed fires, which are allowed in both wilderness and research natural areas, could also result in short term degradation of the air quality. The greatest effect on air quality would come from outside point and non-point air pollution sources.

Biological Resources

Wildlife Habitat and Species

Wildlife Habitat and Species Impacts of Alternative A

Under the current management alternative, natural processes would benefit the wildlife and their habitats. As natural succession progresses, climax vegetation types would dominate in the absence of disturbance, favoring the species that depend on late successional habitats. The climax vegetation would displace wildlife species that need openings and immature forest types. Opportunities to manipulate habitat for the benefit of those plant and wildlife habitats would be substantially reduced.

Wildlife Habitat and Species Impacts of Alternative B

Habitat manipulation may be used to maintain the unique features for which the research natural area was established. The manipulation of habitat would be limited to maintaining the unique features for which the research natural area was established. The habitat manipulation may result in a greater mosaic of habitat and associated wildlife species diversity.

Cultural Resources

Archaeological and Historic Resources

Archaeological and Historic Resources Impacts of Alternative A

There would be no expected change to the archaeological or historic resources by implementing this alternative. Regional archaeologists may conduct or contract archaeological surveys. Archaeological surveys would be designed to avoid known sites, minimize ground disturbance and would be conducted using the minimum tool.

Archaeological and Historic Resources Impacts of Alternative B

Effects would be similar to those in alternative A.

Socioeconomics

Social

Social Impacts of Alternative A

Wilderness provides opportunities for people to experience remoteness, natural quiet, solitude, freedom, and the emotional challenges of self discovery and self reliance. There would be no expected change in providing the public the opportunities to enjoy the character of both wilderness and research natural areas under the current management alternative.

Social Impacts of Alternative B

The ability for the public to the experience the qualities of Wilderness character and the opportunities to experience remoteness, natural quiet, solitude, freedom, and the emotional challenges of self discovery and self reliance would potentially be diminished under this alternative, since the removal of the Wilderness proposal would not guarantee the permanent protection of wilderness character.

Economic

Economic Impacts of Alternative A

The economy of Franklin County is based on a mix of agriculture, tourism and recreation.

This alternative would have no affect on the agriculture of the Franklin County.

The recreational use of wilderness is generally encouraged and expected. The principal emphasis of wilderness management is to manage recreation use to minimize the evidence of human use and provide opportunities for solitude

or primitive recreation. The proposed Shad Island Wilderness area offers opportunities for primitive recreation in the form of hunting. This activity will benefit the economies of both the State of Vermont, with the purchase of hunting licenses, and the tourism of Franklin County, by increasing the annual revenue resulting from increased lodging, restaurant, and shopping activity.

As natural succession progresses, climax vegetation types would dominate, increasing the wilderness characteristics of the area. It is expected that over time that the natural beauty of the area will increase the tourism of Franklin County, resulting in increased revenue coming into the local community from increased lodging, restaurant, and shopping activity.

Economic Impacts of Alternative B
The effects would be expected to similar to that of the current management alternative.

Effects on Socioeconomics

In evaluating the socioeconomic consequences of the actions the two alternatives propose, we evaluated our refuge revenue sharing, refuge visitor expenditures in the local economy, and refuge staff and work-related expenditures in the local economy.

Economic Impacts of Alternative A

Refuge Revenue Sharing
In the fiscal year 2004 (FY04), the actual appropriation by Congress for refuge revenue sharing payments was 46.6 percent of the full amount. Payments in FY04 were $2,464 to Highgate and $4,912 to Swanton, or a total of $7,376. Under current refuge management (alternative A), we propose to acquire only from interested landowners the 253 acres in eight parcels remaining within the existing, approved acquisition boundary. Therefore, we do not expect any major changes in the level of revenue sharing payments, unless Congress changes its annual appropriation for revenue sharing.

Public Use
Public use of the Missisquoi Refuge is high, and climbing. We recorded nearly 38,000 visits in FY04. Hunting, fishing, wildlife observation and photography, and boating have long traditions in the region and are popular on the refuge. At least 280,000 Vermont residents—50 percent of the state population, the highest percentage in the nation—participated in wildlife-associated recreational activities. Those statistics show a significant refuge contribution to Vermont's economy, and highlight the strong connection Vermont residents and non-residents have to their land and wildlife (Kart et al. 2005).

The Missisquoi Refuge is one of the premier spots in the state where these outdoor wildlife enthusiasts spend time and money. Each year, we sell 66 permits to duck hunters at $10 each, and approximately 100 permits to big game and upland game hunters for $10 each, for a total of $1,660 in revenue. Hunters contribute to the local economy by purchasing gas, food, hunting-related equipment and clothing, boating gear, equipment repair services, and lodging.

The refuge also draws increasing numbers of birdwatchers, photographers, naturalists, and boaters. Recently, it was recognized as a premier stop on the Lake Champlain Birding Trail, which likely will lead to increased visitation and, consequently, expenditure of funds in the local economy. In the next few years, we expect more canoeists along the Northern Forest Canoe Trail, which courses from Maine to New York, passing through the refuge on the Missisquoi River. Many consider increased visitation at the refuge as the cornerstone of the Swanton revitalization, as refuge users contribute to the local economy through their consumption of goods and services, rental of equipment locally, and payment of fees for the use of shuttles, equipment, and guide services.

Refuge Staff and Budgets
Refuge staff reside in and spend significant portions of their salaries on daily living expenses in communities near the refuge, thereby generating impacts within the local economies of Highgate, Swanton and, overall, Franklin County. The current, approved refuge staff consists of six permanent employees and one student intern.

- Refuge Manager (GS-13)
- Refuge Operations Specialist (GS-11)
- Wildlife Biologist (GS-11)
- Administrative Support Assistant (GS-6)
- Park Ranger (GS-11)
- Maintenance Mechanic (WG-9)
- Student Intern (Student Career Experience Program (SCEP)) (GS-4)

Two additional positions have been approved, but have never been filled: park ranger/law enforcement (GS-9) and a maintenance worker (WG-5). Based on FY 2005 salary charts, we estimate that annual salaries for the six permanent employees would total more than $407,600, part of that creating economic benefit in the local economy.

We purchase a wide variety of supplies and services for refuge operations and maintenance. According to refuge records in 2005, we spent approximately 81 percent of the annual, non-salary budget expenditures, or $904,136, on goods and services purchased in Franklin County. The total amount of non-salary funds expended in 2005 is above the norm spent annually at the refuge due to significant new construction projects ongoing or funded in that year, but the relative percentage of funds spent locally is similar to a more normal budget year, when the non-salary expenditures total about $110,000.

Economic Impacts of Alternative B

Refuge Revenue Sharing
The economic impacts of refuge revenue sharing in alternative B are similar to those in alternative A. We expect the revenue sharing amount to increase by 10 percent at most under this alternative as we consider more lands and associated waters for conservation by the refuge to protect sensitive habitats nearby. Of the 41,408 acres of land in the Town of Swanton, about 13,000 acres, or 31 percent, are conservation land: the highest percentage of any community in the state. Federal and state wildlife refuges encompass about 7,000 acres of that total; the rest lies in conservation easements, primarily on active farms. Residents have traditionally supported the need to conserve agricultural and wild lands. However, in recent years, housing shortages have made residents increasingly sensitive about conserving more land that perhaps could be developed for housing or businesses. Many recognize that much of the current refuge land is unsuitable for either housing or an agricultural use, because it is generally very low, wet, and lies largely in the floodplain of Lake Champlain or the Missisquoi River. Local residents generally support adding more land of that type to the refuge, seeing it as a good use for that type of land and an economic benefit for their community.

Public Use
We expect the proposed management actions under alternative B to increase visitation levels and refuge revenue and, in turn, increase the economic

benefits to the local communities. We predict an increase to 85,000 visitors annually from increased environmental education, interpretation, and outreach, including expanded Visitor Contact Station hours, enhanced interpretive trails, enhanced hunting, fishing, and boating experiences, and regional population growth and tourism trends.

In addition to the current hunting and special use fees, the refuge is proposing a new, $1.00 activity fee. We will charge a fee of $1.00 per person, unless otherwise specified, for participation in refuge activities, including but not limited to boat tours, owl prowls, woodcock walks, and other wildlife-oriented activities. Those new funds will go into the refuge budget to help offset the costs of the public use program, including maintaining the boat launch, gravel roads, and other facilities and structures. Those new revenues will also increase the funds spent locally by the refuge. We expect that refuge visitors and supporters will see that as a positive economic benefit, providing a mechanism for non-consumptive uses (e.g., birding, hiking, boating), to contribute to refuge operations and maintenance, as some consumptive uses (e.g., big game/upland game and waterfowl hunters) have done for many years.

Refuge Staff and Budgets
Proposed staff for alternative B includes all approved permanent staff positions (eight) in alternative A, plus two additional, permanent positions: Park Ranger (GS 7/9), and Biological Technician (GS 5-7-9). The total salaries for 10 positions would be about $538,000, generating more economic benefit in the local economy than alternative A.

We expect non-salary expenditures in alternative B to increase by $50,000 above their normal levels in alternative A. That will generate an increase in funds spent on goods and services in the local communities, as we expect 80 percent of those non-salary dollars to be spent in Franklin County.

Cumulative Impacts

Cumulative impacts on the physical, biological, and human environment result from the incremental impact of the proposed actions when added to other past, present, and reasonably foreseeable future actions. They can result from individually minor but collectively significant actions over time.

This assessment of cumulative impacts includes the actions of other agencies or organizations if they are interrelated and influence the same environment. Thus, it considers the interaction of activities at the refuge with other actions over larger spatial and temporal scales.

Water Quality and Soils

The greatest cumulative positive impacts on water quality and soils will come from the collaborative partnerships among the Missisquoi River watershed landowners, citizen groups in Missisquoi Bay, Lake Champlain Basin Committee, and state and federal partners. That is particularly relevant to controlling and removing aquatic invasive species, reducing phosphorus loads to Missisquoi Bay, and improving upstream land uses to reduce soil erosion and sedimentation. The cumulative land protection by the refuge, Vermont Agency of Natural Resources (VT ANR), the Vermont Land Trust, The Nature Conservancy (TNC), and interested landowners is perhaps the most effective, long-lasting way to improve water quality and protect soils in the delta region. Alternative B offers the best opportunity to realize those cumulative benefits.

We predict no major, adverse, cumulative impacts on water quality or soils under either of the alternatives. We would use best management practices on any roads, trails, or other infrastructure construction sites to ensure those impacts are avoided or minimized. Those projects are few, and dispersed on the refuge, so their local effects would not be additive.

Air Quality

We expect neither of the alternatives to have any cumulative adverse impacts on air quality locally or regionally in the northern Lake Champlain Basin. The amount of automobile traffic expected from an increase in visitation is minor compared to the steady traffic on Route 78, which bisects the refuge.

Biological Resources—Wildlife and Their Habitats

Both alternatives maintain or improve biological resources on the refuge, in the lower Missisquoi River watershed and the northern Lake Champlain Basin. The combination of our management actions with our state, federal and university partners could result in significant, beneficial cumulative effects by (1) increasing protection and management for federal- and state-listed threatened and endangered species; (2) protecting sensitive wetlands habitats; (3) reducing nuisance, invasive plants; and (4) improving water quality particularly by reducing phosphorus loads and sedimentation. The two alternatives propose strikingly different levels of involvement in those issues.

The refuge has used the Bird Conservation Region (BCR)13 plans, Partners in Flight (PIF), Shorebird, Waterbird and Waterfowl plans, Lake Champlain Basin Program (LCBP) plans, and the Vermont Wildlife Action Plan (WAP) in determining the highest resource priorities for the refuge to protect and manage. That process allows the refuge to prioritize its conservation and management actions toward those resources of concern (wildlife and plant species and habitats) that are of regional as well as local importance. We expect that alternative B would provide the most, cumulative, beneficial impacts on waterfowl, Neotropical migratory birds, rare mussels, turtles and fish, and other wildlife and their habitats.

Public Use

We expect neither of the alternatives to have significant adverse impacts on public use opportunities at the refuge. Most conflicts that occur between users can be avoided by notification (i.e. in refuge brochures, postings), posting trails or outright closing trails (i.e. during hunting season).

Cultural Resources

We expect neither of the alternatives to have significant adverse, cumulative impact on cultural resources in the region. Given the extent of known archaeological sites and artifacts from the refuge, we anticipate a cumulative benefit from the proposed management actions and interpretive programs, which would vary between the two alternatives. The cumulative benefits further accrue from the existing collaborations with UVM and Maine, and the local Abenaki Nation of Missisquoi community. The Vermont Agency of Transportation (VTrans) is proposing a re-alignment of Route 78, including a segment that runs through the refuge. Archaeological studies in this area have been done to identify, map, and remove the artifacts, if necessary to protect their integrity. hat and other large-scale development projects off the refuge have a greater cumulative impact than activities on the refuge.

Unavoidable Adverse Effects

Unavoidable adverse effects are those that could cause significant harm to the human environment but cannot be avoided, even with mitigation measures. We predict that none of the actions in either alternative would result in an unavoidable, adverse environmental impact. When the Service acquires land and places it in federal ownership, towns lose some property tax revenue. However, we are proposing focused land acquisition projects that would have minor impacts on the tax base, and would provide more benefits to the community. In both alternatives, we use adaptive management, enabling us to alter management strategies if unforeseen situations arise, and thereby, avoid adverse effects.

Relationship of Short-Term Uses and Long Term Productivity

This section evaluates the balance between local, short-term uses and long-term productivity.

Both alternatives strive to maintain or enhance the long-term productivity and sustainability of natural resources on the refuge. To varying degrees, the alternatives propose actions that promote watershed- or landscape-scale partnerships aimed at protecting and restoring upland and aquatic habitats. The alternatives strive to protect our federal trust species and the habitats they depend on, evidenced by the limits on public access in certain seasons and in some locations. Environmental education and interpretation are a priority in each alternative, to encourage refuge visitors and neighbors to support and participate in environmental stewardship and promote a land conservation ethic.

Alternative B provides more opportunity for outreach and enforcement to prevent uses determined not appropriate or incompatible, such as riding horses, ATVs, or snowmobiles. The purpose of determining compatibility is to reduce impacts on wildlife and habitats and enhance the long-term productivity of refuge sites. Alternative A would not provide the staffing or funding levels to ensure the elimination of those uses.

In summary, we predict that both alternatives would contribute positively to maintaining or enhancing the long-term productivity of the lower Missisquoi River watershed and northern Lake Champlain Basin and, that alternative B would have the greatest positive impact.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments are just that, except perhaps in the extreme long-term or under unpredictable circumstances. An example of an irreversible commitment is an action that contributes to the extinction of a species. Once extinct, it can never return.

By comparison, irretrievable commitments are those that are lost for a period. Such a commitment can be reversed, given sufficient time and resources; but represents a loss in production or use for a period. One example is the maintenance of forest and shrubland as open field and grassland. If for some reason grasslands no longer were an objective, they would gradually revert to shrubland or forest.

The only irreversible commitment of resources affecting local communities is Service land acquisition. Alternative A limits acquisition to the current, approved acquisition boundary. Alternative B proposes the acquisition of targeted parcels to protect intact, fully functioning wetlands and associated riparian areas or lands that contribute to maintaining a large, unfragmented block of habitat. Once those lands become part of the refuge, it is unlikely they would ever revert to private ownership. However, we would acquire them from interested landowners, after discussions with our conservation and community partners, and with the support of the state.

The irretrievable commitments of resources by the refuge include the maintenance of grasslands and the maintenance of clearings and early successional forest for species of conservation concern that depend on them. Alternative B proposes that we allow some of the grasslands unproductive for grassland-nesting birds to revert naturally to shrubland or floodplain forest.

Table 4.2. Summary of effects of management actions by alternative

Refuge Resources	Alternative A	Alternative B
	Physical Environment	
Water Quality and Soils	Service acquisition of remaining 253 acres within approved acquisition boundary increases direct, permanent benefits to water quality and soil productivity	Service acquisition of the remaining 253 acres plus protection of additional targeted areas that include intact, fully functioning wetlands and associated riparian areas, including floodplain forest will provide greater direct, permanent protection of water quality and soils
	Potential long-term benefits from control of nuisance aquatic invasive species	Expanded inventory, monitoring and control of nuisance aquatic invasive species would greatly enhance the opportunity to control and minimize these species to the benefit of water quality
	Slight increase in negative impacts from increase in visitation beyond the current 38,000 annual visits, particularly from increases in boating activity that could cause bank erosion	Anticipated increase in visitation to 85,000 visits per year has the potential to increase negative impacts on water quality and soils, particularly from boating. This would be reduced by increased law enforcement patrols, monitoring of bank erosion, and implementing actions to mediate any problems
	Some soil compaction from use on existing Refuge trails	Some soil compaction from use of existing and modest expansion of trails; offset by use of boardwalks in particularly sensitive areas; shortening of the Jeep Trail near tip of Shad Island
	Some low intensity, short duration negative effects from annual use of herbicides and prescribed fire	Some low intensity, short duration negative effects from annual use of herbicides and prescribed fire
		Greater collaborations with Missisquoi River watershed and Lake Champlain Basin partners to alleviate water quality problems, particularly phosphorus and sediment
	No violations of Federal or State Clean Water Act standards	No violations of Federal or State Clean Water Act standards

Refuge Resources	Alternative A	Alternative B
	Physical Environment (cont'd)	
Air Quality	Reduction of fossil fuel emissions at the Refuge through alternative energy sources including wind turbine, photovoltaic, geothermal	Same as Alternative A
	Prohibits use of snowmobiles and ATVs that can degrade air quality	Same as Alternative A
	Potential for contributing direct and indirect short duration air pollution from prescribed burning of some grasslands; however, implementation would adhere to stipulations in Refuge Fire Management Plan	Fewer acres (139 versus 338) of grasslands will be considered for prescribed fire annually; however prescribed fire could be used in Maquam Bog so similar potential short duration air pollution as in Alternative A
	Negligible contribution to air pollution from Refuge staff and visitor vehicle emissions	Some increase in contribution to air pollution from increase in Refuge visitation to 85,000; however some of this increase would be from canoes, kayaks, and other non-motorized (non-polluting) boats
	No violation of Federal or State Clean Air Act standards	No violation of Federal or State Clean Air Act standards
	Biological Resources	
Habitats and Associated Native Species	Continue to protect wetlands that comprise 95% of the Refuge and pursue protection of remaining 253 acres within acquisition boundary that encompass wetlands	In addition to protecting existing wetlands, pursue protection of other intact, fully functioning wetlands and associated riparian areas including floodplain forest
	No change in management priorities or effort; maintain focus on great blue herons, black terns, migrating waterfowl, osprey and wood ducks, American woodcock, spiny softshell turtles, grasslands (338 acres)	Some shift in management focus and enhanced effort including: ■ Inventory and map distribution of SAV and explore restoration
	Continue to work with partners on controlling invasive species, particularly Eurasian water milfoil and water chestnut	■ Greater focus and effort on inventory, monitoring, and control of nuisance invasive species include development of a GIS database to track distribution and control
	Continue to post areas for closure to recreational uses during sensitive times	■ Shift away from artificial nest structures for wood duck and osprey
	Undesirable impacts to wildlife can result from wildlife observation and photography, particularly in the case of breeding and nesting birds, resting and roosting waterfowl, and wintering deer. Current monitoring and assessment of these uses indicate no significant disturbance is occurring.	■ Evaluate existing dike system and determine need and feasibility of expansion ■ Shift 199 acres of the existing 338 acres of grasslands to natural shrubland; maintain remaining 139 acres as grassland

Refuge Resources	Alternative A	Alternative B
Biological Resources (cont'd)		
Habitats and Associated Native Species (cont'd)	Direct disturbance to non-target birds would likely occur from hunting and associated hunter activity, but would be short term. These impacts are temporary and are mitigated by the presence of adjacent refuge habitat where hunting does not occur	■ Develop management plans for the Shad Island and Maquam Bog Research Natural Areas; Recommend removal of Shad Island from pending (since 1974) Wilderness Designation ■ Continue early successional habitat management ■ Engage Vermont Natural Heritage in evaluating unique natural communities
	The act of fishing and the mere presence of people in boats, whether motorized or non-motorized, can disturb and displace waterfowl, other migratory birds, and wildlife in general. These impacts are avoided, minimized or mitigated by area closures, public relations and field visits, and law enforcement patrols.	This alternative provides a much greater opportunity to engage visitors, including boaters, birders, anglers and hunters, in protecting the wetland habitats in the Missisquoi delta. We would engage these recreational users by providing more interpretive information at boat launches, on kiosks, in our outreach to the media, local businesses and tour guides, and at our Visitor Contact Station.
	The use of motorized boats is not expected to have a significant impact based on current levels of use and the expectation and observation that visitors are complying with postings and other regulations.	Our proposed, expanded staff, specifically, a law enforcement position, would provide much-needed oversight of the behavior and affects of recreational users on and near the refuge. That is crucial, as we anticipate an increase in visitation, and more people explore the rivers, creeks, and bays on the refuge.
	Snowmobiles have less obvious effects on larger animals, moderate effects on medium-sized animals and drastic effects on small animals, notably those overwintering in sub-snow environments (Bury 1978).	Same as A

Refuge Resources	Alternative A	Alternative B
	Public Use	
	Complete the fully accessible Discovery Trail within the next year	Same as A
	Individuals, who want to participate in wildlife viewing and photography, feel areas of the refuge are effectively "off-limits" to them during the hunting season	We propose several trail closures or trail advisories for non-hunters during the hunting season to ensure a high quality hunt and reduce non-hunter inconvenience.
	Currently a conflict has arisen among hunters utilizing the delta portion of the refuge.	The refuge manager will evaluate the effectiveness of instituting a lottery permit system for deer hunting on the delta to reduce the number of hunters at the delta portion of the refuge. The proposal to change the areas that woodcock and snipe hunting are allowed will improve the quality of the experience for hunters but also maintain a more ecologically sensitive area (delta lakeshore area).
	The anticipated impacts of sport fishing at the refuge have not been significant.	Shortening of Jeep trail will reduce the access that fisherman have to fishing areas off the end of the Jeep trail. We do not anticipate a significant impact of fishing experience since we are only closing a small portion of the trail.
	Problems with unleashed dogs on the refuge include lost dogs, other hikers and their dogs intimidated by unleashed dogs, visitor disgust with waste left on refuge trails, thus depriving them of a peaceful visit, and harassment and injury to wildlife.	We propose a "no dogs" policy to protect sensitive habitats, wildlife, and visitors from dogs running loose.
	Existing refuge trails were developed for pedestrian use and are other wise ill-suited for concurrent pedestrian and cyclist use. We would continue to enforce against bicycling where it is not allowed.	Same as A
	Cross-country skiers and snowshoers tend to feel a conflict with snowmobilers because the noise from snowmobiles disturbs their solitude and quiet while visiting the refuge.	Same as A

Refuge Resources	Alternative A	Alternative B
	Cultural Resources	
Archaeological and Historic Resources	Continue to work cooperatively with the local Abenaki Nation of Missisquoi community to identify and protect known sites of spiritual or historic importance Continue to incorporate cultural resources interpretive displays at the Visitor Contact Station Limited law enforcement capabilities to patrol and protect known archaeological sites Compliance with the Archaeological Resources Protection Act, the Native American Graves Protection & Repatriation Act, and the National Historic Preservation Act	Expand collaborative partnership with local Abenaki Nation of Missisquoi community to identify, monitor, and interpret cultural resources Expand cultural resource interpretation on the Refuge as more information becomes available Expand access to artifacts found on the Refuge for research and education Hiring of a law enforcement staff would provide much needed patrol and protection of known archaeological sites Compliance with the Archaeological Resources Protection Act, the Native American Graves Protection & Repatriation Act, and the National Historic Preservation Act
	Special Designation Areas	
Physical Environment	There would be no expected change to the water quality. The natural functions of the watershed would be maintained. Potential impacts to the watershed would be limited to local and recreational and community activities. There would be no expected change to the soils. There would be no expected change to the air quality. Wildland fires and prescribed fires could results in short term degradation of the air quality.	Same as A Soil productivity could be reduced if the areas were open to increased or sustained use. The expected effects would include increased soil compaction, displacement, and erosion. Same as A
Biological Resources	Under this alternative, natural processes would benefit the wildlife and the habitats. As natural succession progresses, climax vegetation types would dominate in the absence of disturbance, favoring the species that depend on late successional habitats.	Habitat manipulation may be used to maintain the unique features for which the research natural area was established. The habitat manipulation may result in a greater mosaic of habitat and associated wildlife species diversity.

Refuge Resources	Alternative A	Alternative B
	Special Designation Areas (cont'd)	
Cultural Resources	There would be no expected change to the archaeological or historic resources. Any archaeological surveys conducted would be designed to avoid known sites, minimize ground disturbance and would be conducted using the minimum tool.	Same as A
Socioeconomics	There would be no expected change in providing the public the opportunities to enjoy the character of both wilderness and research natural areas under the current management alternative.	The ability for the public to experience the qualities of Wilderness character and the opportunities to experience remoteness, natural quiet, solitude, freedom, and the emotional challenges of self discovery and self reliance would potentially be diminished under this alternative.
	This alternative would have no affect on the agriculture of the Franklin County.	Same as A
	The proposed Shad Island Wilderness area offers opportunities for primitive recreation in the form of hunting. This activity will benefit the economies of both the State of Vermont, with the purchase of hunting licenses, and the tourism of Franklin County, by increasing the annual revenue resulting from increased lodging, restaurant, and shopping activity.	Same as A
	As natural succession progresses, climax vegetation types would dominate, increasing the wilderness characteristics of the area. It is expected that over time that the natural beauty of the area will increase the tourism of Franklin County, resulting in increased revenue coming into the local community from increased lodging, restaurant, and shopping activity.	Same as A

Refuge Resources	Alternative A	Alternative B
	Socioeconomics	
Economic Impacts	Refuge Revenue Sharing payments will remain about the same given only modest changes in Refuge ownership More than 38,000 visitors annually to the Refuge continue to contribute to the local economy through consumption of goods and services, equipment rental, guide services Refuge staff and work-related expenditures will continue to contribute to the local economy	Refuge Revenue Sharing payments will remain about the same as Alternative A given only modest changes in Refuge ownership Increase in Refuge visitation to 85,000 visits will increase expenditures in the local economy An additional 4 staff and increases in work-related expenditures from proposed projects under this Alternative will increase the contribution to the local economy Propose a new $1.00 activity fee for participation in Refuge activities including but not limited to boat tours, owl prowls, woodcock walks to off-set increasing administrative costs for managing and overseeing recreational uses; Hunting fees remain the same; will evaluate feasibility of implementing a lottery permit system for deer hunting